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Abstract

SAFETY ASPECTS OF SPENT FUEL TRANSPORT

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The transportation of spent fuel, as with other commodities considered dangerous, involves a balance of safety and economy. Of particular importance is protection of the public from radiological hazards in the event of a transportation accident. Information regarding the likelihood and consequences of accidents is so incomplete, however, that justifiable degree of safety is at present a matter of administrative and engineering judgment. Weighing heavily on the side of safety are the public unfamiliarity with the hazards and the absence of physiological warning against some of the hazards.

In the United States during 1957-1962 there were ten reported accidents or malfunctions of casks in transit and in terminals. In six of these there was no escape of radioactive material; in the other four cases, some contaminated water escaped but there was no radiation injury. Fortunately, none of the accidents subjected a cask to severe impact or fire.

The combination of factors involved in designing casks is somewhat unusual, and includes provision for radiation shielding, for removal of heat generated by fission products, for avoiding the escape of radioactive materials in transit, for containment of the contents in a severe accident, and in some cases for prevention of the possible formation of a critical array. Various methods that have been used or considered to accomplish these objectives are discussed.

Methods of calculating resistance of unprotected casks to impact are unreliable; however, drop tests of models and full size casks have shown good correlation, with specimens varying in size from about 30 lb. (13.6 kg) to 30 000 lb. (13 600 kg). The use of shock-absorbing materials to protect casks has been analyzed theoretically, and the conclusions have been verified experimentally.

Work now underway to provide data for calculation of the effects of fire on casks is described. If it is found that providing a high degree of fire resistance is very difficult or costly, careful consideration of the expected frequency and consequences of cask failure will be required. Some accident statistics are presented.

Methods of mounting casks on vehicles may significantly affect the consequences of accident. This subject is under study. Major considerations are outlined.

Certain aspects of design have been covered by the U.S. Interstate Commerce Commission regualtions, and considered by the Bureau of Explosives in granting permits. More detailed performance requirements are set forth in the proposed federal regulation, 10CFR Part 72, which, however, is under review by the USAEC for possible revision. The American Standards Association has published a guide entitled, "American Standard Recommended Practice for Design and Operation of Shipping Containers for Irradiated Solid Fuel from Nuclear Reactors." Important requirements and recommendations of these documents are summarized.

Several procedural devices may be used to help ensure safety of shipment. Among these are routing, type of vehicle, scheduling of time for certain movements, location of a car in a train, speed limitations, and in some cases courier escort. A broad objective, however, is to provide equipment suitable for safe handling by standard methods.